

Summary:

This document contains information about the DMSP F11 Satellite. The DMSP F11 satellite is in a near circular, sun synchronous, polar orbit. The DMSP mission is to provide global visible and infrared cloud data and other specialized meteorological, oceanographic and solar-geophysical data in support of world wide Department of Defense (DoD) operations. A description of the mission is provided as is information about the spacecraft and its environment. The ground data system is briefly described.

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1. Platform or Data Collection Environment Overview:

Platform or Data Collection Environment Long Name, Platform Acronym:

Defense Meteorological Satellite Program (DMSP) Block 5D-2 Satellite F11, DMSP F11

Platform Introduction:

DMSP, originally known as the Defense System Applications Program (DSAP) and the Defense Acquisition and Processing Program (DAPP), is a long-term USAF effort in space to monitor the meteorological, oceanographic and solar-geophysical environment of the Earth in support of DoD operations. All spacecraft launched have had a tactical (direct readout) and a strategic (stored data) capacity. In December 1972, DMSP data was declassified and made available to the civil/scientific community. The USAF maintains an operational constellation of two near-polar, sun-synchronous satellites.

Collection Environment:

Satellite

Platform Program Management:

The DMSP program office is located at the Space Systems Division, Air Force Material Command, Los Angeles Air Force Station, Los Angeles, California 90009-2960. Funding is provided by the Department of Defense (DoD).

Platform Mission Objectives:

The DMSP mission is to provide global visible and infrared cloud data and other specialized meteorological, oceanographic and solar-geophysical data in support of world wide Department of Defense (DoD) operations.

Platform Parameters:

DMSP Satellite F11 was built by General Electric's Astro-Space Division (now part of Martin Marietta Astro Space). It was launched on November 28, 1991 from Vandenberg AFB, California using an Atlas E rocket. The spacecraft is 3.7 meters in length with a diameter of 1.2 meters with an on-orbit mass of 831 kilograms. It has a design lifetime of 48 months. Power is provided through a 9.29 sq-m solar cell panel. Attitude is controlled using momentum wheels and magnetic coils using a strap-down star sensor and gyros as the reference.

Coverage Information:

DMSP Satellite F11 is in a near circular, sun synchronous, polar orbit.

- Maximum Altitude: 878 km



- Minimum Altitude: 841 km
- Inclination: 98.8 deg
- Period: 101.9 minutes
- Eccentricity: 0.00129
- Ascending Equator Crossing Time (Local Time):
 - At Launch: 18:11
 - Current (09/02/95): 18:25
- Swath Width:
 - Visible and Infrared Imagery - 3000 km
 - Microwave Imagery - 1400 km
 - Temperature Sounder - 1500 km
 - Water Vapor Profiler - 1500 km
- Launch Date - November 28, 1991
- End Mission (Operational Support - F11 is currently (9/2/95) providing secondary support with sensors SSM/I, SSM/T, SSM/T-2, SSJ/4, SSIES2 still providing data.

Attitude Characteristics:

- Pointing Accuracy: 0.01 deg (primary), 0.12 deg (backup)
- Stability: maximum rate - 0.03 deg/sec per axis.

Short term changes in attitude are measured using three orthogonal gyroscopes. A strap down star sensor is used to bound the effects of gyroscope drift. The desired attitude is computed based upon a star catalog and an ephemeris table uplinked to the spacecraft daily. Three-axis attitude control is maintained in the orbital configuration by automatic momentum exchange between three momentum wheels. Onboard magnetic coils provide controlled interaction with the earth's magnetic field to prevent the accumulation of wheel secular momentum. Operations of these coils is under control of the closed loop spacecraft attitude control system. the momentum wheels and gyroscopes are backed up by a fourth skewed unit for redundancy.

Data Collection System:

Data is transmitted in real time to tactical terminals world-wide. Data is also stored using on-board recorders for transmission to and processing by the Air Force Global Weather Central (AFGWC), Offutt AFB, Nebraska and the Fleet Numerical Meteorology and Oceanography Center (FNMOC), Monterey, California. Both AFGWC and FNMOC relay the SSM/I, SSM/T and SSM/T2 data to the National Environmental Satellite, Data, and Information System (NESDIS). AFGWC also sends the entire data stream to the National Geophysical Data Center (NGDC).

Communication Links:

DMSP uses S-band links at 1.024 Mbps for the tactical real time transmissions. Stored data are transmitted at 2.66 Mbps to receiving sites at

- Fairchild AFB, Washington,
- Thule, Greenland,
- AF Remote Tracking Station, Hawaii and the
- New Hampshire Tracking Station.

Data are then relayed at 3.072 Mbps via commercial geostationary communications satellite to AFGWC and FNMOC. Spacecraft commanding is done at L-band at a 2 Kbps rate.

List of Sensors/Instruments:

- OLS - Operational Linescan System
- [SSM/I - Special Sensor Microwave Imager](#)
- SSM/T - Special Sensor Microwave Temperature Sounder
- SSM/T-2 - Special Sensor Microwave Water Vapor Profiler
- SSIES-2 - Special Sensor Ion and Electron Scintillation Monitor
- SSJ/4 - Special Sensor Precipitating Electron and Ion Spectrometer
- SSB/X-2 - Special Sensor Gamma/X-Ray Detector



2. Ground Segment Information:

Tracking and Control:

DMSP satellite command and control is performed by the 6th Satellite Operations Group at Offutt AFB, Nebraska.

Data Acquisition and Processing:

Data is transmitted in real time to tactical terminals world-wide. Data is also stored using on-board recorders for transmission to and processing by the Air Force Global Weather Central (AFGWC), Offutt AFB, Nebraska and the Fleet Numerical Meteorology and Oceanography Center (FNMOC), Monterey, California. Both AFGWC and FNMOC relay the SSM/I, SSM/T and SSM/T2 data to the National Environmental Satellite, Data, and Information System (NESDIS). AFGWC also sends the entire data stream to the National Geophysical Data Center (NGDC).

Latitude Crossing Times:

Ascending Equatorial Crossing Time (Local Time):

- At Launch: 18:11
- Current (09/02/95): 18:25

3. References:

1. L. Dubach, C. Ng, NSSDC's Compendium of Meteorological Space Programs, Satellites, and Experiments, March 1988.
2. H.J. Kramer, Observation of the Earth and its Environment - Survey of Missions and Sensors, 2nd Edition, Springer-Verlag, ISBN: 3-540-578587, May 1994.

4. Glossary of Terms:

- OLS - The Operational Linescan System (OLS) measures visible (0.4-1.1 micrometers) and infrared (10.25-12.6 micrometers) wavelengths to provide day and night cloud cover imagery. The satellite measures data at a 0.56 km resolution, which is averaged on board, to produce global coverage at 2.7 km resolution. All of the 2.7 km resolution (smooth) data is downlinked to the ground sites while a small amount of the 0.56 km resolution (fine) data is stored and downlinked. The OLS is the primary sensor on each DMSP satellite.
- [SSM/I - Special Sensor Microwave Imager](#).
- SSM/T-1 - Special Sensor Microwave Temperature Sounder. The SSM/T is a seven channel, cross track nadir scanning passive microwave sounder having a field of view of 14.4 degrees. It measures the Earth surface and atmospheric emission in the 50 to 60 GHz oxygen band. At nominal altitude, the subtrack spatial resolution is an circle of 174 km at nadir and an ellipse of 213x304 km toward the limb. There are seven total cross-track scan positions separated by 12 degrees at frequencies 50.5, 53.2, 54.35, 54.9, 58.4, 58.825 and 59.4 GHz.
- SSM/T-2 - Special Sensor Microwave Water Vapor Profiler
- SSJ/4 - Precipitating Plasma Monitor. The SSJ/4 measures the transfer energy, mass, and momentum through the magnetosphere-ionosphere in the Earth's magnetic field. The SSJ/4 sensor consists of four electrostatic analyzers that record the flux of precipitating ions or electrons at 20 fixed energy channels between 50 eV and 30 keV.
- SSIES-2 - Special Sensor Ionospheric Plasma Drift/Scintillation Meter. The SSIES measures the ambient electron density and temperatures, ambient ion density, the average ion temperature and molecular weight, the plasma drift and scintillation at the DMSP orbital altitude.
- SSB/X-2 - Gamma Ray Particle Detector. The SSB/X-2 is an array-based system which detects the location, intensity, and spectrum of X-rays emitted from the Earth's atmosphere.

See the [EOSDIS Glossary](#) for a more general listing of terms related to the Earth Observing System project.

5. List of Acronyms:

AFB - Air Force Base

AFGWC - Air Force Global Weather Central

DMSP - Defense Meteorological Satellite Program

DoD - Department of Defense

FNMOC - United States Navy Fleet Numerical and Oceanography Center



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NESDIS - National Environmental Satellite, Data, and Information Service
NGDC - National Geophysical Data Center
OLS - Operational Linescan System
SSBX-2 - Special Sensor Gamma Ray Particle Detector
SSIES - Special Sensor Ionospheric Plasma Drift/Scintillation Meter
SSJ/4 - Special Sensor Precipitating Plasma Monitor
SSM/I - Special Sensor Microwave Imager
SSM/T-1 - Special Sensor Microwave Temperature Sounder
SSM/T-2 - Special Sensor Microwave Water Vapor Profiler
USAF - United States Air Force
URL - Uniform Resource Locator

See the [EOSDIS Acronyms](#) for a more general listing of terms related to the Earth Observing System project.

6. Document Information:

Document Revision Date:

June 24, 1996; May 21, 1997; November 26, 1997

Document Review Date:

June 18, 1996

Document ID:

DMSP F-11 Platform Document

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